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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/058,426	01/30/2002	Daisuke Komada	020060	4298

38834 7590 02/22/2005

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EXAMINER

BARRECA, NICOLE M

ART UNIT PAPER NUMBER

1756

DATE MAILED: 02/22/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/058,426	Applicant(s) KOMADA ET AL.	
	Examiner Nicole M Barreca	Art Unit 1756	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 21 December 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-10, 13 and 14 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 2-10 is/are allowed.
- 6) ☒ Claim(s) 1, 13 and 14 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>12/21/04</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. Claims 1-10, 13 and 14 are pending in this application.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 1 and 14 are rejected under 35 U.S.C. 102(b) as being anticipated by Olsen (EP 926 715).

4. Olsen discloses a fabrication method for an integrated circuit. An oxide layer and/or a thin dielectric layer (applicant's first film being made of a material having a different etch resistance from SiC), is formed on a semiconductor wafer. This is followed by the deposition of a silicon carbide layer (applicant's second film). The silicon carbide layer is deposited using hydrogen containing sources gases, such as silane/methane or trimethylsilane, and is therefore hydrogenated. A photoresist is deposited and patterned. The silicon carbide and other underlying layers are etched [00115]-[0016]. The fifth embodiment teaches etching the SiC layer using NF₃/CHF₃/CF₄/Ar/O₂/H₂ [0026].

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and

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the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claim 1 is rejected under 35 U.S.C. 103(a) as being unpatentable over

Passemand (US 6,24,053) in view of Ring (US 6,475,889).

7. SiOCH layer 32 (first film) is formed over semiconductor substrate. SiCH layer 33 (second film) is formed on layer 32. Photosensitive film 40 is deposited and etching hole 41 is defined. A hole is etched in the SiCH layer 33 with layer 32 serving as a stop or barrier, followed by removal of the photosensitive layer. The etching is continued through layer 32. Passemand is silent on the gas mixture used to etch the second film and does not disclose that the second film of silicon carbide is etched using a fluorocarbon gas added with one of SF₆ and NF₃. Ring teaches that conventional methods of etching silicon carbide include using NF₃ or SF₆ diluted with Ar and CF₄/O₂ (col.10, 23-25). It would have been obvious to one of ordinary skill in the art to etch the silicon carbide (second film) in the method of Passemand using a fluorocarbon gas added with one of SF₆ and NF₃ because Ring teaches that conventionally silicon carbide is etched using NF₃ or SF₆ diluted with Ar and CF₄/O₂.

8. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Olsen or Passemand in view of Ring as applied to claim 1 above, and further in view of Dabbaugh (US 6,362,094).

9. The references do not disclose that the silicon carbide film is deposited by CVD using tetramethylsilane and carbon dioxide in a flow rate ratio of 0.2 to 0.6. Dabbaugh teaches semiconductor manufacturing method using silicon carbide. Dabbaugh teaches that the silicon carbide layer may be conventionally formed using plasma

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enhanced CVD using a silane source and an oxygen source. Tetramethylsilane may be used as the silane source, while carbon dioxide layer be used for the oxygen source (col.3, 47-67). It would have been obvious to one of ordinary skill in the art to deposit the silicon carbide layer by CVD using tetramethylsilane and carbon dioxide because Dabbaugh teaches that this a known method for deposition of hydrogenated silicon carbide. Dabbaugh is silent on the flow rates of the source gases and does not disclose that the tetramethylsilane and the carbon dioxide flow rates are in a ratio of 0.2 to 0.6. Source gas flow rates are known in the art to be result-effective variables. It would within the ordinary skill of one in the art to determine the optimal flow rates ratio for the tetramethylsilane and carbon dioxide in the methods above by routine experimentation and to have the ratio be 0.2 to 0.6, if required, because source gas flow rates are result effective variables and the discovery of an optimum value of a result-effective variable is ordinary within the skill of the art, as taught by *In re Boesch* (617 F.2d 272, 205 USPQ 215 (CCPA 1980)).

Allowable Subject Matter

10. Claims 2-10 are allowed.

11. The following is a statement of reasons for the indication of allowable subject matter: the prior art fails to teach or suggest a method for manufacturing a semiconductor device comprising the steps in the order as recited in the applicant's claims, including etching first and/or third films of hydrogenated silicon carbide using a fluorocarbon and one of SF₆ and NF₃ and etching a second film of insulating material having a different etching resistance from silicon carbide.

Conclusion

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nicole M Barreca whose telephone number is 571-272-1379. The examiner can normally be reached on Monday-Thursday (9AM-7PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Huff can be reached on 571-272-1385. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Nicole M Barreca
Examiner
Art Unit 1756



2/15/05